2-Pair

Managed SHDSL Ethernet Extender

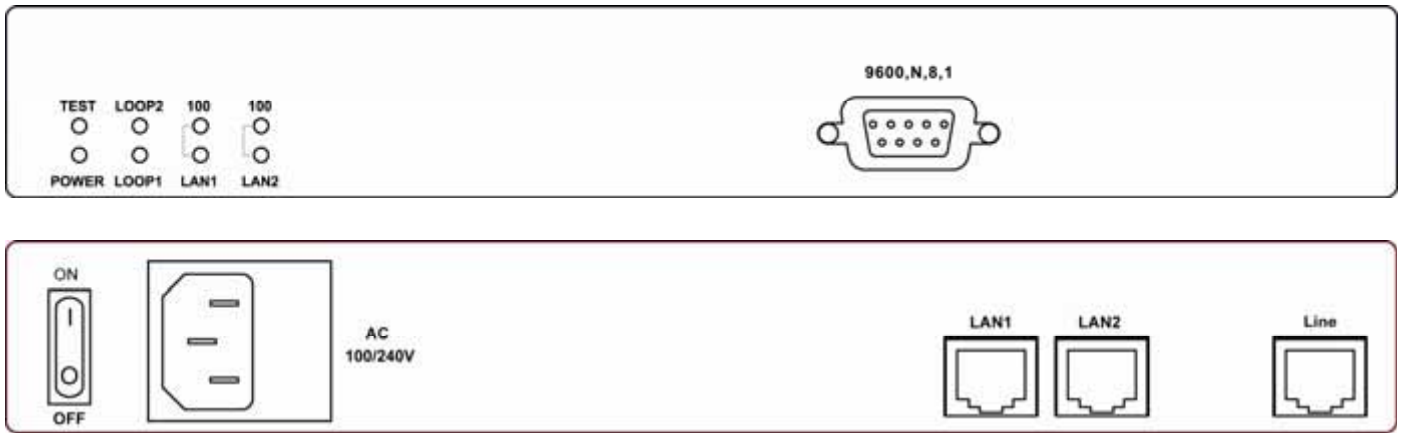
User's Manual

1. Quick Start Guide

This quick start guide describes how to install and use the Managed SHDSL Ethernet Extender. This is the Ethernet Extender of choice to extend 10/100 Ethernet circuits by using existing straight pair copper wire.

1.1. Physical Description

1.1.1. The Port Status LEDs and Power Inputs



LEDs	State	Indication
POWER (Green)	On	Power supply is normal.
TEST (Yellow)	On	Self testing after powered on.
Line		
LOOP1 (Green)	Flash	SHDSL connection is in progress.
	On	Loop1 connects successfully.
LOOP2 (Green)	Flash	SHDSL connection is in progress.
	On	Loop2 connects successfully.
Ethernet		
LAN1 (Green)	On	LAN1 port is in connection.
	Flash	Data activity on LAN1 port.
10/100M (Green)	On	LAN1 Ethernet connection is at 100Mbps.
LAN2 (Green)	On	LAN2 port is in connection.
	Flash	Data activity on LAN2 port.
10/100M (Green)	On	LAN2 Ethernet connection is at 100Mbps.

1.1.2. The 10/100Base-TX and Ethernet Extender Connectors

The 10/100Base-TX Connection
The following lists the pinouts of 10/100Base-TX RJ-45 connector.

Pin	Regular Ports	Uplink ports
1	Output Transmit Data +	Input Receive Data +
2	Output Transmit Data -	Input Receive Data -
3	Input Receive Data +	Output Transmit Data +
4	NC	NC
5	NC	NC
6	Input Receive Data -	Output Transmit Data -
7	NC	NC
8	NC	NC

The Ethernet Extender Connection
The RJ-48 connector pinouts for SHDSL line interface.
Pin 4 & Pin 5 for Loop 1.
Pin 1 & Pin 2 for Loop 2.

1.1.3. The Data Rate and Distance of Ethernet Extender Port

1 pair Data Rate (Kbps)	2 pair Data Rate (Kbps)	Max. Reach (m)	Max. Reach (ft.)
4,608	9,216	1,828	6,000
3,072	6,144	2,895	9,500
2,304	4,608	3,505	11,500
2,048	4,096	3,657	12,000
1,544	3,088	3,962	13,000
1,152	2,304	4,419	14,500
768	1,536	4,572	15,000
512	1,024	5,029	16,500
384	768	5,334	17,500
256	512	5,791	19,000
192	384	6,248	20,500

<Note> This table is based on SHDSL connection with 1dB noise.

1.2. Functional Description

- ITU-T Rec. G.991.2 G.shdsl.bis Compliance.
- SHDSL Trellis Coded Pulse Amplitude Modulation (TCPAM) Line Code.
- Fixed Data Rate Selection from 10.8Mbps to 128Kbps for 2-pair SHDSL lines.
- Adaptive Data Rate from 4608Kbps to 192Kbps for 1-pair SHDSL mode.
- Adaptive Data Rate from 9216Kbps to 384Kbps for 2-pair SHDSL mode.
- Maximum Transmission Distance: 22,500 ft over 26AWG twisted pair.
- Noise Margin $\geqq$ 1 dB is guaranteed for fixed rate and adaptive rate modes.
- STU-R follows STU-C's speed for 192Kbps~2304Kbps in 1-pair fixed rate mode.
- STU-R follows STU-C's speed for 384Kbps~4608Kbps in 2-pair fixed rate mode.
- RJ-48 Connector for SHDSL line connections.
- Two RJ-45 Connectors for 10/100Base-TX Ethernet Switch ports.
- Ethernet Auto-Negotiation for 10/100Base-TX.
- Ethernet Auto-MDIX for Auto Tx/Rx Swap.
- Console Port for Network Management Configurations.
- 8 LED status indicators.
- Power feedings: 100/240VAC.

1.3. Console Configuration

The Ethernet Extender provides an RS232C console port for user to monitor the OA&M status through a VT100 terminal.

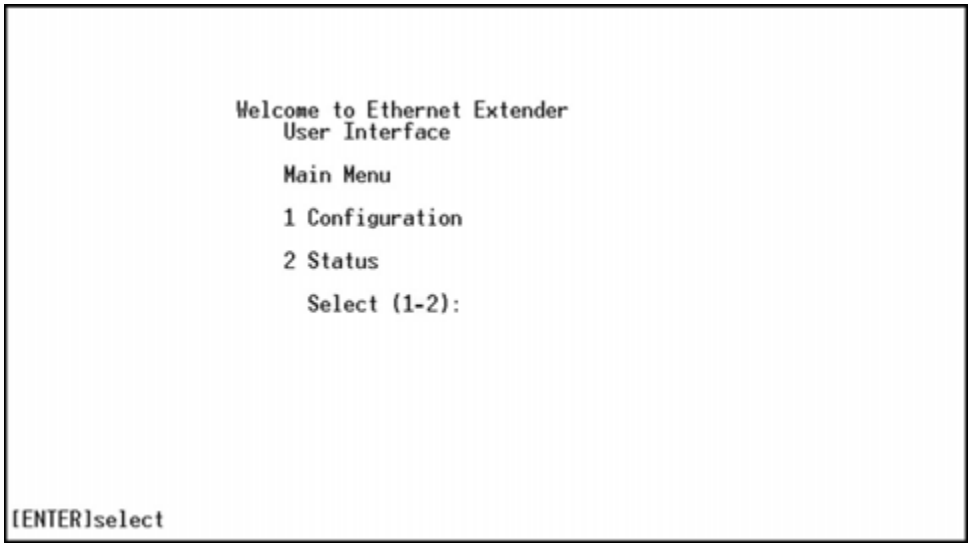
Connect the RS232 cable to the COM port of the computer. Set the personal computer to VT100 or VT102 type through HyperTerminal. Press the <ESCAPE> key and the main menu will be shown on the screen of the terminal. The terminal operations can then start.

If the <ESCAPE> key is pressed and the screen of the terminal does not display, this may be due to the incorrect COM port setting. Choose the right COM port (COM1 or COM2) on the computer, and press the <ESCAPE> key again to make sure that the main menu appears on the terminal screen. Note that the COM port should be set as below.

Baud rate	Data bits	Parity	Stop bit	Flow control
9600bps	8	none	1	none

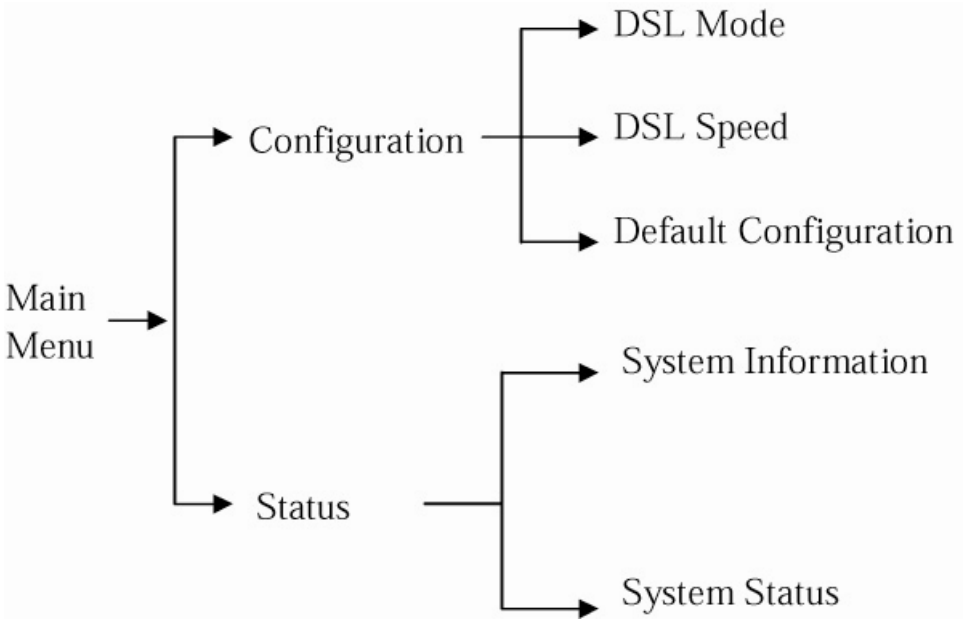
1.3.1. Main Menu

Main Menu will display the connection status of the Ethernet Extender and settings including two sections: Configuration, and Status.



1.3.2. Pull-down Tree Structure of Main Menu

The pull-down tree structure of the main menu is shown as below.



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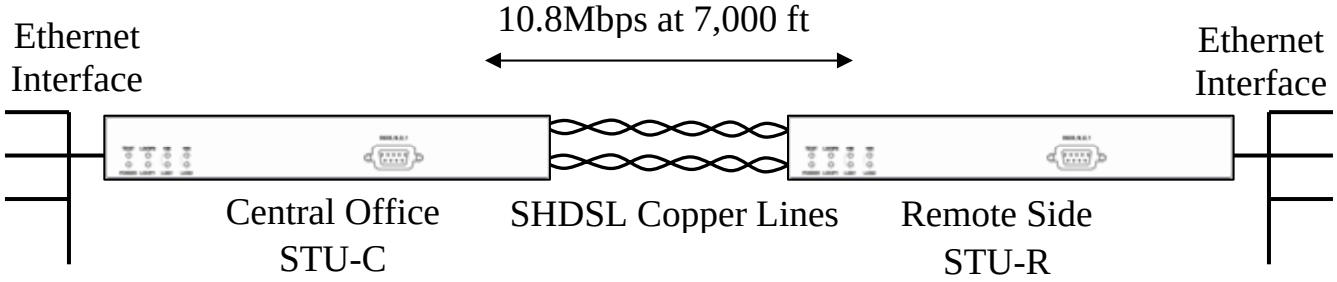
3. Introductions

The Managed SHDSL Ethernet Extender, an SHDSL (Single-pair High-bit-rate Digital Subscriber Line) LAN Extender, provides a broadband full duplex transmission with bandwidth aggregation up to 10.8Mbps over 2 pairs of copper line for point-to-point LAN connectivity between two Ethernet networks. The distance can reach up to 7,000 feet (about 2.1 Km) and 10,000 feet (about 3 Km) at the maximum rate of 10.8Mbps and 9.216Mbps for two pairs of 24AWG (0.5 mm) copper wire, and could reach even around 22,500 feet (about 6.8 Km) for 192Kbps. With its rate adaptive features, this Managed SHDSL Ethernet Extender may provide longer reach on transmission distance. Users can also select a fixed data rate for the copper line ranging from 192Kbps to 10.8Mbps. The Managed SHDSL Ethernet Extender provides a console port for user to configure the settings and to monitor the connection status.

Each Managed SHDSL Ethernet Extender can be configured into either STU-C for central side or STU-R for remote side. The Managed SHDSL Ethernet Extender conforms to the ITU-T Rec. G.991.2, to meet G.shdsl.bis network requirements. A pair of Managed SHDSL Ethernet Extender offers a cost effective symmetrical broadband solution for bandwidth-hungry applications such as LAN-to-LAN connectivity, Internet Access and VoIP applications over two twisted pairs.

4. Application Notes

Ethernet To Ethernet Bridge Extension



5. Features

- ITU-T Rec. G.991.2 G.shdsl.bis Compliance.
- SHDSL Trellis Coded Pulse Amplitude Modulation (TCPAM) Line Code.
- Fixed Data Rate Selection from 10.8Mbps to 128Kbps for 2-pair SHDSL lines.
- Adaptive Data Rate from 4608Kbps to 192Kbps for 1-pair SHDSL mode.
- Adaptive Data Rate from 9216Kbps to 384Kbps for 2-pair SHDSL mode.
- Maximum Transmission Distance: 22,500 ft over 26AWG twisted pair.
- Noise Margin $\geqq$ 1 dB is guaranteed for fixed rate and adaptive rate modes.
- STU-R follows STU-C's speed for 192Kbps~2304Kbps in 1-pair fixed rate mode.
- STU-R follows STU-C's speed for 384Kbps~4608Kbps in 2-pair fixed rate mode.
- RJ-48 Connector for SHDSL line connections.
- Two RJ-45 Connectors for 10/100Base-TX Ethernet Switch ports.
- Ethernet Auto-Negotiation for 10/100Base-TX.
- Ethernet Auto-MDIX for Auto Tx/Rx Swap.
- Console Port for Network Management Configurations.
- 8 LED status indicators.
- Power feedings: 100/240VAC.

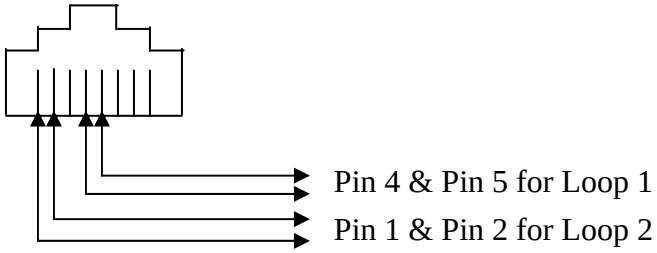
6. Packing Contents

Inside the package you should find:
(1) One Managed SHDSL Ethernet Extender unit with dimension of 260x151x44 (mm)
(2) One power cord
(3) One CAT 5 Ethernet Cable
(4) One User's Manual

Please check if the packing is damaged before unpacking or any component is missing. If so, please contact your dealer immediately for replacement.

7. Installation Procedures

Step 1: Connect SHDSL Lines (2 pairs) to RJ-48 connector on the Managed SHDSL Ethernet Extender back panel.



RJ-48 Connector Pin Assignment for SHDSL Line Interface

Step 2: Connect Ethernet to RJ-45 Port with CAT 5 LAN cable.

Step 3: Connect the power cord to the Managed SHDSL Ethernet Extender AC outlet.

Step 4: Turn on the power switch. Set one Managed SHDSL Ethernet Extender as STU-C from console port, and the other Managed SHDSL Ethernet Extender as STU-R.

Step 5: Set the desired Data Rate for SHDSL connection from the console port. Note that both Managed SHDSL Ethernet Extenders must set the same data rate settings.

Step 6: Both units of Managed SHDSL Ethernet Extender will automatically connect with each other.

Turn on the power switch, and this Managed SHDSL Ethernet Extender will then execute self-test routines. There will be 2 or more handshaking cycles when adaptive rate is selected. The system will automatically adapt to maximum rate according to the loop distances. The maximum adaptive rate is 4608Kbps for 1-pair mode and 9216Kbps for 2-pair mode. The maximum fixed data rate is 10.8Mbps.

8. Front Panel LED Indicators

There are 8 LED indicators on the front panel of the Managed SHDSL Ethernet Extender displaying the current status. These LED indicators are described as following.

POWER： "Green On" shows Managed SHDSL Ethernet Extender power supply is normal.

TEST ："Yellow On" shows Managed SHDSL Ethernet Extender is self testing after powered on.

LOOP1 ： "Green Flash" shows SHDSL connection is in progress.
： "Green On" shows SHDSL loop1 connects successfully.

LOOP2 ： "Green Flash" shows SHDSL connection is in progress.
： "Green On" shows SHDSL loop2 connects successfully.

LAN1 ： "Green On" shows LAN1 port is in connection.
： "Green Flash" shows data activity on LAN1 port.

10/100M： "Green On" shows LAN1 Ethernet connection is at 100Mbps.

LAN2 ： "Green On" shows LAN2 port is in connection.
： "Green Flash" shows data activity on LAN2 port.

10/100M： "Green On" shows LAN2 Ethernet connection is at 100Mbps.

9. Console Port Control

The Managed SHDSL Ethernet Extender provides an RS232C console port for user to monitor the OA&M status through a VT100 terminal. This section covers the operation procedures, settings and for all screen selections.

Connect the RS232 cable to the COM port of the computer as shown in the following diagram. Set the personal computer to VT100 or VT102 type through HyperTerminal. Press the <ESCAPE> key and the main menu will be shown on the screen of the terminal. The terminal operations can then start.

If the <ESCAPE> key is pressed and the screen of the terminal does not display, this may be due to the incorrect COM port setting. Choose the right COM port (COM1 or COM2) on the computer, and press the <ESCAPE> key again to make sure that the main menu appears on the terminal screen. Note that the COM port should be set as 9600bps, none parity, 8 data bit, and 1 stop bit.

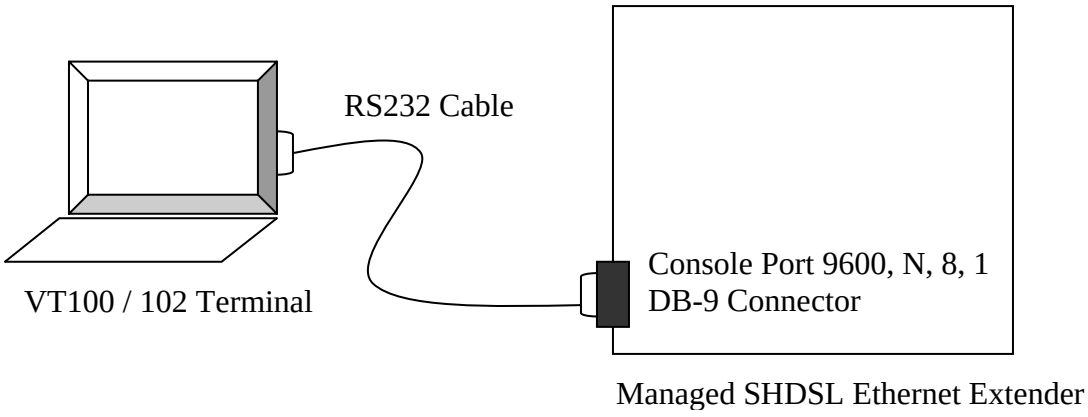


Figure 9-1: Connection for Console Port with RS232 Terminal

9.1. Main Menu

Main Menu will display the connection status of the Managed SHDSL Ethernet Extender unit and settings including two sections: Configuration, and Status. For details please refer to Table 9-1.

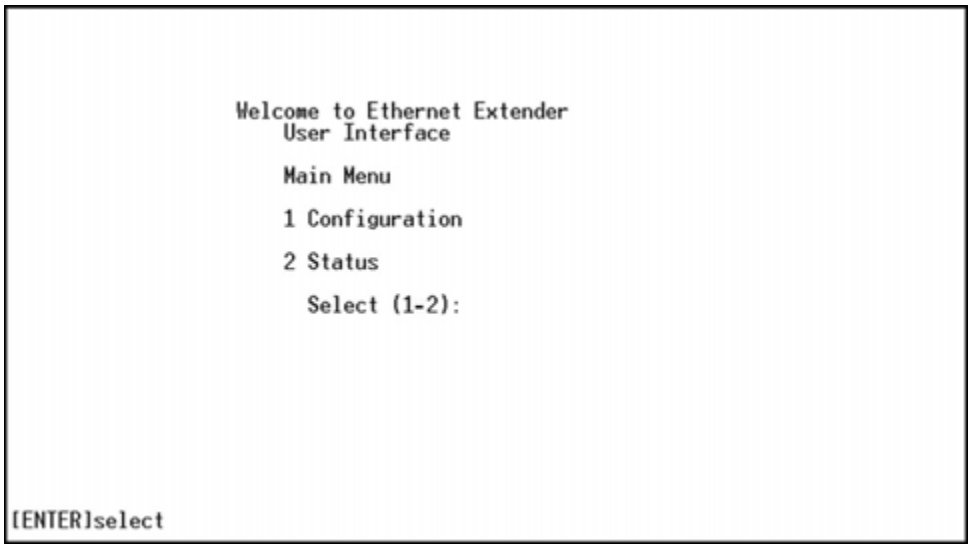


Table 9-1 Main Menu

The pull-down tree structure of the main menu is shown in Figure 9-2.

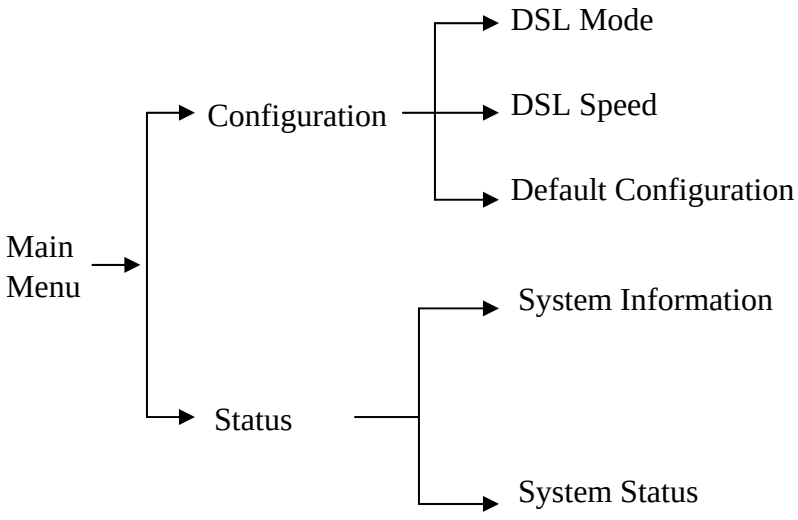


Figure 9-2: Pull-down Tree Structure of the main menu

9.2. Configuration Screen

Configuration screen will display the selections of connection for the Managed SHDSL Ethernet Extender unit and the screen includes three selections: DSL Mode Settings, DSL Speed Settings, and Default Configuration.

For details please refer to Table 9-2.

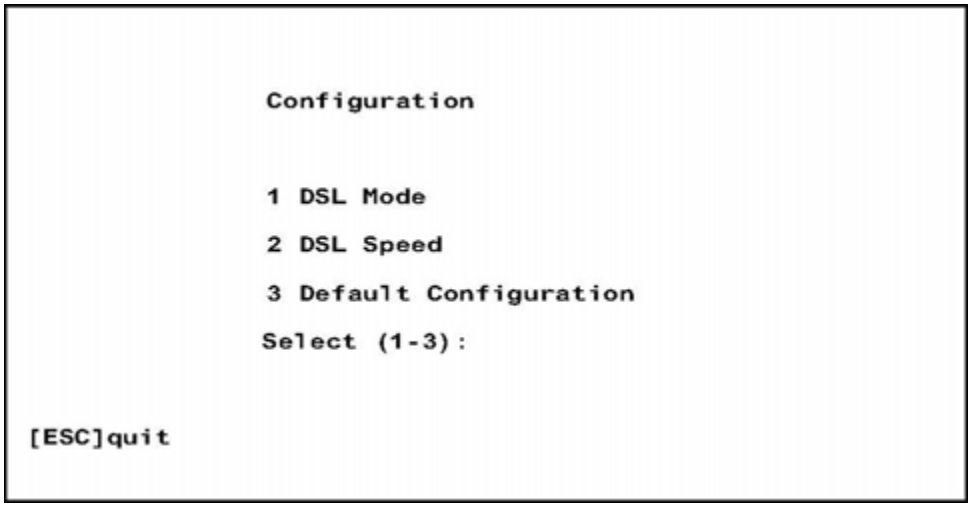


Table 9-2 Configuration screen

DSL Mode Settings:

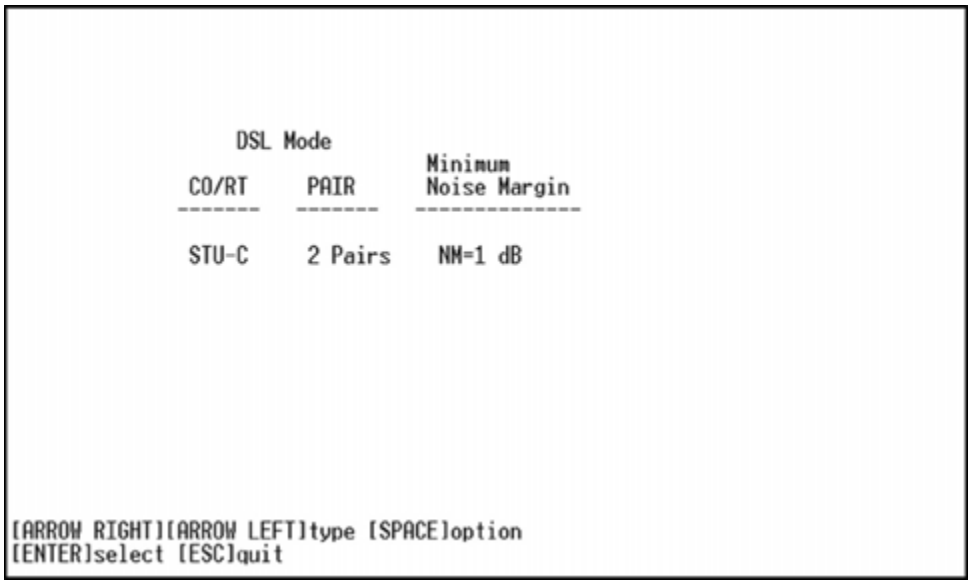


Table 9-3: DSL Mode Settings screen

This screen provides DSL mode settings and user can update the settings from this screen.

CO/RT:

The item of CO/RT has 2 options: STU-C and STU-R. To establish a successful connection for two Managed SHDSL Ethernet Extender units, it is necessary to set one unit to STU-C and the other unit to STU-R.

2P/1P:

The item of 2P/1P has 2 options: 1 Pair and 2 Pairs. This Managed SHDSL Ethernet Extender supports both 1-pair and 2-pair applications. To establish a successful connection for two Managed SHDSL Ethernet Extender units, it is necessary to set the two units to the same selection.

DSL Speed Settings:

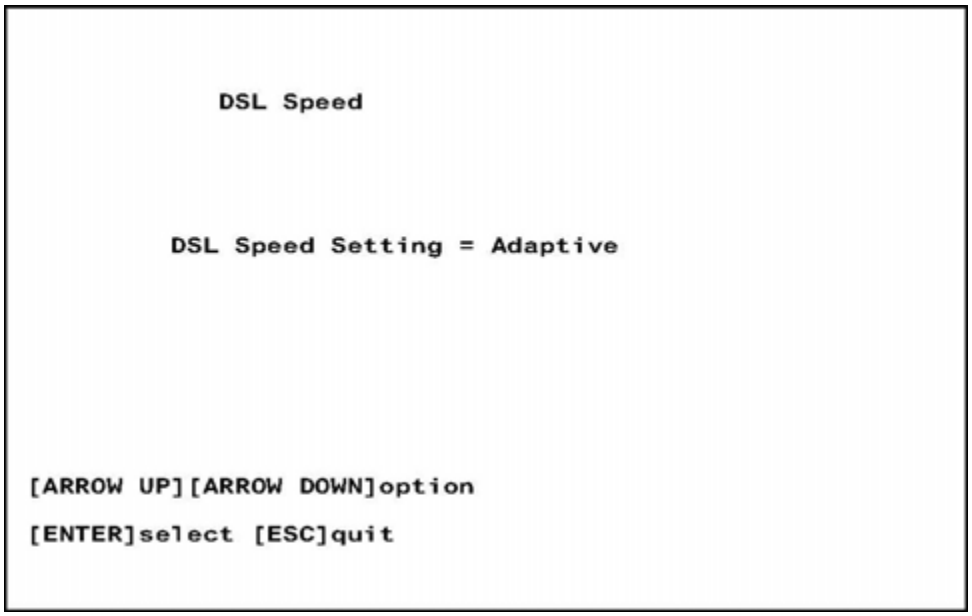


Table 9-4 DSL Speed Settings screen

This screen provides DSL Speed Settings and user can configure DSL speed to set the transmission rate.

For 1-pair setting in the DSL Mode menu, the options are as following;
64Kbps, 128Kbps, 192Kbps, 256Kbps, 384Kbps, 512Kbps, 768Kbps, 1152Kbps, 1536Kbps, 1544Kbps, 2048Kbps, 2304Kbps, 2560Kbps, 3072Kbps, 3584Kbps, 4096Kbps, 4608Kbps, 5120Kbps, 5696Kbps and Adaptive speed.

For 2-pair setting in the DSL Mode menu, the options are as following;
128Kbps, 256Kbps, 384Kbps, 512Kbps, 768Kbps, 1024Kbps, 1536Kbps, 2304Kbps, 3072Kbps, 3088Kbps, 4096Kbps, 4608Kbps, 5120Kbps, 6144Kbps, 7168Kbps, 8192Kbps, 9216Kbps, 10.2Mbps, 10.8Mbps and Adaptive speed.

The user must set both units of Managed SHDSL Ethernet Extender to the same speed selection in order to establish a successful connection for 1-pair 64Kbps, 128Kbps, 2560Kbps, 3072Kbps, 3584Kbps, 4096Kbps, 4608Kbps, 5120Kbps, 5696Kbps, and for 2-pair 128Kbps, 256Kbps, 5120Kbps, 6144Kbps, 7168Kbps, 8192Kbps, 9216Kbps, 10.2Mbps, 10.8Mbps and Adaptive speed. For the rest of speed options from 192Kbps up to 2304Kbps, the STU-R will follow the speed of STU-C.

When setting for adaptive rate, 2 or more activation cycles are necessary. The system will automatically adapt to maximum speed according to the loop distances. The maximum speed is 4608Kbps for 1-pair mode and 9216Kbps for 2-pair mode.

Default Configuration Setting:

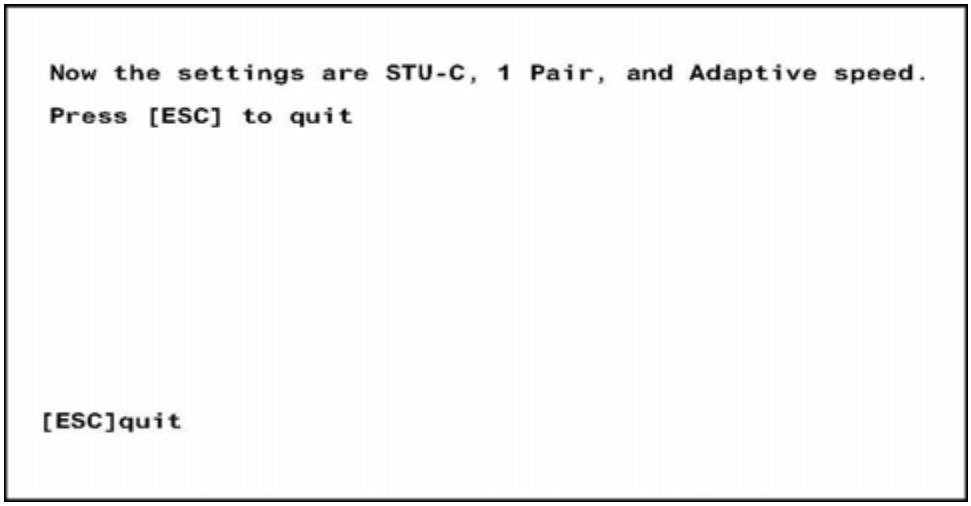


Table 9-5 Default Configuration Setting screen

When Default Configuration is selected, all the settings of this Managed SHDSL Ethernet Extender will go back to default settings. For the screen as shown in Table 9-5, it indicates setting is finished and press <ESC> key will be back to previous screen. The default settings of this Managed SHDSL Ethernet Extender are as following:

STU-C
1 Pair
Adaptive speed

9.3. Status Screen

The Status screen shows the connection status of this Managed SHDSL Ethernet Extender unit. The screen covers two selections: System Information and System Status. For details please refer to Table 9-6.

```
                Status


                1 System Information
                2 System Status
                Select (1-2):

[ENTER]select [ESC]quit
```

Table 9-6 Status screen

System Information:

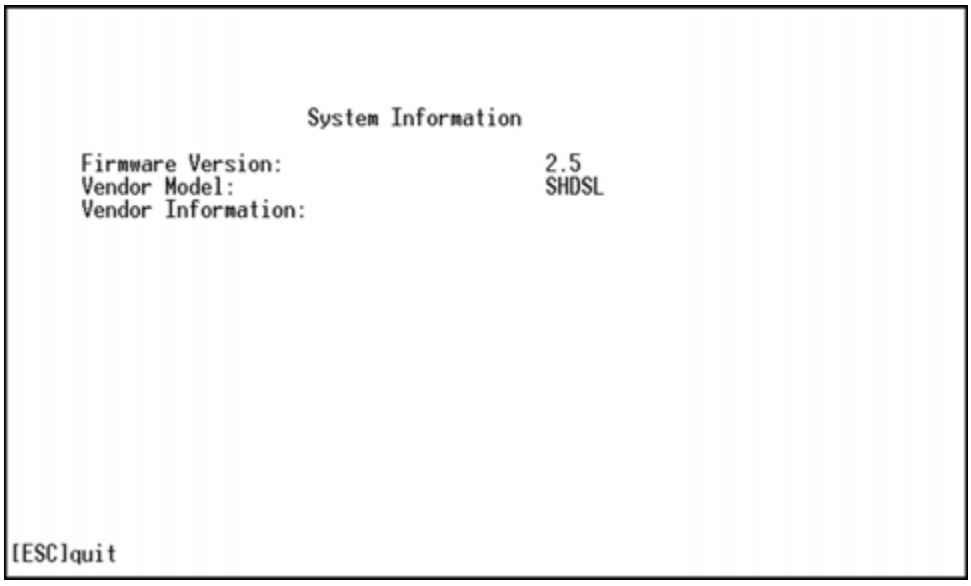


Table 9-7 System Information screen

Items list in the above screen are explained as follows:

Firmware Version:

Indicates the firmware version in this unit.

Vendor Model:

Indicates this device's vendor model name.

Vendor Information:

Indicates the vendor's web site information.

System Status screen:

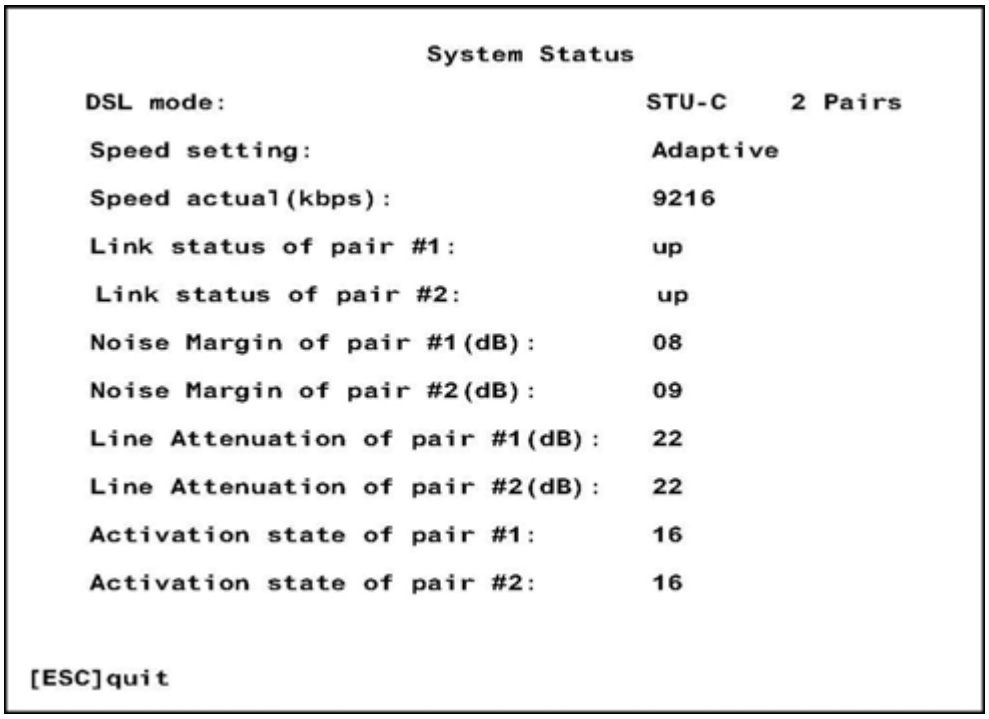

System Status
DSL mode: STU-C 2 Pairs
Speed setting: Adaptive
Speed actual(kbps): 9216
Link status of pair #1: up
Link status of pair #2: up
Noise Margin of pair #1(dB): 08
Noise Margin of pair #2(dB): 09
Line Attenuation of pair #1(dB): 22
Line Attenuation of pair #2(dB): 22
Activation state of pair #1: 16
Activation state of pair #2: 16
[ESC]quit

Table 9-8 System Status screen. The distance of this example is 6K ft and 26AWG.

Items list in the above screen are explained as follows:

DSL mode:

Indicates the current DSL mode setting.

Speed setting:

Indicates the current DSL speed setting.

Speed actual (Kbps):

Indicates the actual DSL speed in kilobit per second.

Link status of pair #1:

Indicates the DSL connection status (either up or down) for pair #1.

Link status of pair #2:

Indicates the DSL connection status (either up or down) for pair #2.

Noise Margin of pair #1(dB):

Indicates the Noise Margin in dB of pair #1.

Noise Margin of pair #2(dB):

Indicates the Noise Margin in dB of pair #2.

Line Attenuation of pair #1(dB):

Indicates the Line Attenuation value in dB of pair #1. The maximum value is 43 dB when the DSL distance is 22500 ft, 26AWG.

Line Attenuation of pair #2(dB):

Indicates the Line Attenuation value in dB of pair #2. The maximum value is 43 dB when the DSL distance is 22500 ft, 26AWG.

Activation state of pair #1(dB):

Indicated the DSL startup activation state of pair #1. The value starts from 05 and gradually reaches the final value 16. The value 16 is the DSL link up state value. The general activation state sequence is 05 → 20 → 10 → 12 → 16.

Activation state of pair #2(dB):

Indicated the DSL startup activation state of pair #2. The value starts from 05 and gradually reaches the final value 16. The value 16 is the DSL link up state value. The general activation state sequence is 05 → 20 → 10 → 12 → 16.

10. Specifications

Applicable Standards	IEEE802.3 10Base-T, IEEE802.3u 100Base-TX, IEEE802.3x, Ethernet over SHDSL
Fixed Ports	2 x 10/100Mbps Ethernet port with RJ-45 connector 1 x Ethernet Extender port with RJ-48 connector
Speed 10Base-T 100Base-TX Ethernet Extender	 10/20Mbps for half/full-duplex 100/200Mbps for half/full-duplex Fixed Data Rate Selection: 128Kbps to 10.8Mbps for 2-pair copper wire Adaptive Data Rate: 192Kbps to 4608Kbps for 1-pair copper wire Adaptive Data Rate: 384Kbps to 9216Kbps for 2-pair copper wire
Switching Method	Store-and-Forward
Forwarding rate	14,880/148,810pps for 10/100Mbps
Cable 10Base-T 100Base-TX Ethernet Extender	 2-pair UTP/STP Cat. 3, 4, 5 up to 100m 2-pair UTP/STP Cat. 5 up to 100m 24 or 26AWG twisted pair copper wire
LED Indicators	Per Unit (2 LEDs)- POWER, TEST
	Per Port- LAN1, LAN2 (RJ-45, 2 LEDs): Link/Activity, Speed Line (RJ-48, 2 LEDs): LOOP1, LOOP2
Dimensions	260mm (W) × 151mm (D) x 44mm (H) (10.24” (W) x 5.94” (D) x 1.73” (H))
Weight	2.5Kg (5.51lbs.)
Power	100 ~ 240VAC, 50 ~ 60Hz Internal Universal PSU
Power Consumption	8W Max.
Operating Temperature	0°C ~ 50°C (32°F ~ 122°F)
Storage Temperature	-20°C ~ 70°C (-4°F ~ 158°F)
Humidity	5% ~ 95%, non-condensing
Emissions	CE Mark, Class A FCC Part 15, Class A VCCI, Class A